WORKING PAPER

A Numerical Observation on the Planck-to-Electron Mass Ratio

Possible Connection to the Particle Content of the Standard Model

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Status: Numerical hypothesis at 2.34σ from CODATA 2022. Physical interpretation suggestive but unproven. Testable if G is measured 3× more precisely.

1. Observation

We define the dimensionless ratio:

$$\mathbf{n = \log(m_p/m_e) / \log(1/\alpha)}$$

where $m_p = \sqrt{(\hbar c/G)}$ is the Planck mass, m_e is the electron mass, and α is the fine structure constant.

Numerically, using CODATA 2022 values:

$$n = 10.47261956...$$

We observe that this number is well approximated by:

$$\mathbf{n \approx 10 + 13/(17\varphi)}$$

where $\varphi = (1+\sqrt{5})/2$ is the golden ratio. Numerically: $10 + 13/(17\varphi) = 10.47261423$, giving a deviation of 5.3×10^{-6} in n, corresponding to **2.34σ** on G (CODATA 2022 uncertainty $\pm1.5\times10^{-15}$ N·m²/kg²).

2. Predicted Value of G

If the relation $n = 10 + 13/(17\varphi)$ were exact, the predicted value of G would be:

$$\mathbf{G = \hbar c / (m_e^2 \times (1/\alpha)^{(2n)})}$$

$$G_p = 6.67465 \times 10^{-11}\ \mathrm{N\cdot m^2/kg^2}$$

$$G_{CPDATA} = 6.67430 \times 10^{-11}\ \mathrm{N\cdot m^2/kg^2}$$

The deviation is 0.0053% — within 2.34 times the CODATA uncertainty.

3. Possible Physical Interpretation

The numbers 10, 13, 17, and φ may have physical significance:

17 = total number of elementary particles in the Standard Model

6 quarks + 6 leptons + 4 gauge bosons + 1 Higgs = 17

13 = matter particles + Higgs (without gauge bosons)

6 quarks + 6 leptons + 1 Higgs = 13 = 17 - 4

13/17 = ratio of matter content to total particle content

10 = spacetime dimension of string theory (or SO(10) GUT group)

10 = 6 quarks + 4 gauge bosons, or the rank of SO(10)

φ = golden ratio, present in mp/me, α, τ_n, and $\sin^2\theta w$ in the same framework [1,2,3]

If confirmed, the formula would read: the Planck-to-electron mass ratio is determined by the particle content of the Standard Model (17 total, 13 matter) and the golden ratio, with an integer base of 10.

4. Why G Is Difficult

G is the least precisely measured fundamental constant — relative uncertainty of 22 ppm. Different laboratory measurements disagree by up to 500 ppm, well beyond their individual uncertainties. This makes it impossible to confirm or rule out the proposed relation with current data.

If G were measured 3× more precisely (below 8 ppm), the 2.34σ deviation would either grow (ruling out the formula) or shrink (supporting it).

5. Open Questions

- Why does φ appear in the Planck-to-electron mass ratio?
- Is 10 related to 10D string theory or SO(10)?
- Why 13 and 17 — the particle counts of the Standard Model?
- Can this be derived from a theoretical framework?

References

[1] J. Brindel, Perturbative Series for mp/me, Zenodo (2026). DOI: 10.5281/zenodo.18693489

[2] J. Brindel, Fine Structure Constant, Zenodo (2026). DOI: 10.5281/zenodo.18694690

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[4] CODATA 2022, NIST. https://physics.nist.gov/cuu/Constants/

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